

# Issuance Transmittal Sheet

**NASA**  
National Aeronautics and  
Space Administration

**George C. Marshall Space Flight Center**  
Marshall Space Flight Center, Alabama 35812

Issuance Number: MMI 5300.12B	Date: November 24, 1995
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**Material Transmitted:**

1. Marshall Management Instruction, MMI 5300.12B, Subject: "Part and Material Traceability"
2. This instruction is being revised to:
  - a. Incorporate organizational changes; and
  - b. Update/clarify Part and Material Traceability requirements.

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Remove MMI 5300.12A, dated May 27, 1976, and replace with the attached MMI 5300.12B.

# Management Instruction

**NASA**

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Originating Organization: CR01	Effective Date: November 24, 1995	<b>MMI</b> 5300.12B
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**Subject:** Part and Material Traceability

\*1. PURPOSE

To establish MSFC policy requirements for part and material traceability for flight and flight associated hardware; provide guidance to program/project managers and design organizations in properly determining and correctly specifying the minimum traceability requirements necessary to ensure project success; and to identify functional responsibilities for MSFC organizations involved with implementing the requirements of this instruction.

\*2. APPLICABILITY

This Instruction applies to all MSFC organizational elements involved in the design, procurement, fabrication, inspection, test, and operation of flight and flight associated hardware for MSFC projects. It applies to MSFC contractors to the extent specified in procurement documents.

\*3. REFERENCES (Only applicable parts of the most recent edition apply.)

- a. NHB 5300.4(1B), subject: "Quality Program Provisions for Aeronautical and Space System Contractors"
- b. NHB 5300.4(1C), subject: "Inspection System Provisions for Aeronautical and Space System Materials, Parts, Components and Services"
- c. NHB 5300.4(1D-2), subject: "Safety, Reliability, Maintainability, and Quality Provisions for the Space Shuttle Program"
- d. NHB 5300.4(1F), subject: "Electrical, Electronic, and Electro-mechanical (EEE) Parts Management and Control Requirements for NASA Space Flight Programs."

\*Changed by this revision.



- e. MSFC-STD-555, subject: "MSFC Engineering Documentation Standard"
- f. CR5300.36, subject: "MSFC Quality Assurance Plan for In-house Operations"

\*4. POLICY

- a. Program Requirements - It is the policy of this Center that a part and raw material traceability program be established and maintained for flight and flight associated hardware, as a means of tracing, by records, the history of parts and materials within a system. The Program/Project Manager shall use this document as a guide in identifying traceability levels for hardware which requires traceability. Additional traceability requirements may be imposed by Program/Project Managers as deemed necessary.
- b. Traceability Records - The Center will maintain traceability records on in-house fabricated hardware. The Procurement Office shall specify and impose traceability requirements through data requirements packages incorporated into the contracts. Applicable documentation shall be submitted by contractors or appropriate MSFC organizations who manufacture parts or components, or who supply or fabricate parts or components for assembly in-house.

\*5. RESPONSIBILITIES

- a. The Program/Project Manager is responsible for specifying appropriate levels of part and material traceability for flight and flight associated hardware in compliance with the requirements of this document. See attachment B, which provides specific information on traceability levels and guidance on how they should be assigned.
- b. The Chief Engineer is responsible for recommending appropriate levels of part and material traceability to the Program/Project Manager and for insuring implementation of those requirements within the program/project.
- c. Design Organizations, as required by the program/projects' traceability needs, will specify traceability requirements on the lowest level drawings and Engineering Parts Lists (EPL's) per MSFC drawing standard requirements (MSFC-STD-555). Traceability requirements and material traceability

\*Changed by this revision.

levels will be specifically identified during design and evaluated at design reviews to ensure that the proper level of traceability is identified and that the identification method, type, and location are properly specified. Attachment B, Figure 1 shows a typical sequence used in specifying traceability requirements in engineering drawings.

NOTE: When parts, components, etc., are to be procured to MSFC design documentation, and serial and/or lot numbers are necessary, the design organization will obtain the numbers from the Configuration Management Release Desk, per MSFC-STD-555, and include them in the purchase request/order.

- d. Manufacturing Organizations will implement traceability requirements during fabrication operations. Serial and lot numbers when required by engineering documentation, shall be obtained from the Configuration Management Office Release Desk per MSFC-STD-555.
- e. Quality Assurance Organizations will :
  - (1) Assure traceability requirements are implemented for flight and flight associated hardware in accordance with design documentation, procurement documents and the requirements of this document.
  - (2) Assure that MSFC organizations, contractors, subcontractors and vendors comply with traceability and identification requirements, and notify the initiating activity of inadequate documentation.
  - (3) Establish and maintain a records system which will specifically identify parts, materials and next higher levels of assembly for all parts or materials requiring traceability.
  - (4) Assign trace numbers and maintain test records on materials as required.
  - (5) Assure recording of the Unique Identifying Numbers (UIN's), Part Identification Numbers (PIN's) on appropriate documentation.
  - (6) Maintain an as-built database for every identified deliverable end item when required by the program/project office.
- f. The Configuration Management Office Release Desk will be responsible for serial and lot number assignments, per MSFC-STD-555.

- g. The Procurement Office will insure that traceability requirements specified by Program/Project Managers are communicated to the appropriate contractors, subcontractors, and vendors.

6. CANCELLATION

MMI 5300.12A, "Part and Material Traceability," dated May 27, 1976

(Original signed by)

G. P. Bridwell  
Director

\*Attachments:

- A. Definitions
- B. Application Guidance

Distribution:

SDL-4

\*Changed by this revision.

DEFINITIONS

1. Article - A unit of hardware or software or any portion thereof required by the contract.
2. Assembly - A number of parts or subassemblies or any combination thereof joined together to perform a specific function.
3. Certificate of Conformance (COC) - A contractor's written statement certifying that supplies or services comply with contract requirements. The certificate of conformance may be used instead of source inspection at the discretion of the contracting officer.
4. Chemical and Physical Analysis
  - a. Actual - Material Test Reports that certify and document that actual chemical and physical attributes meet the raw material specification. This includes specific percentages of each chemical element and physical tensile strength results for each lot/batch.
  - b. Typical - Material Test Reports that certify the chemical and physical attributes of a raw material fall within the specified range as denoted in the material specification for each lot/batch.
5. Component - A combination of parts, devices, and structures usually self-contained, which performs a distinctive function in the operation of the overall equipment; e.g., a "black-box," transmitter, encoder, or cryogenic pump.
6. Engineering Parts List (EPL), MSFC Form 420 - An engineering document that identifies part/parts information including Release authority, part/parts numbers, quantities, weights, traceability requirements and part/parts descriptions required to build the respective assemblies and subassemblies.
7. Flight Associated Hardware - Includes all qualification test hardware and launch critical ground support equipment (GSE).
8. Flight Hardware - All parts, components, subassemblies, assemblies and equipment assigned for flight.
9. Fracture Critical - A classification which assumes that fracture or failure of the part/component resulting from the occurrence of a crack will result in a catastrophic hazard which could lead to loss of flight vehicle or crew.

10. Inspection Report (IR), MSFC Form 312 - An MSFC quality control document used to reflect the configuration and quality status of a part, component, subassembly, or assembly.
11. Material Traceability Levels - A numerical code ranging from 1 to 4, used to identify material traceability requirements on Engineering Parts Lists (EPL's). It identifies traceability requirements for individual parts, assemblies or subassemblies.
12. Mill Markings - Physical item identification markings applied to raw materials in accordance with the appropriate Federal Standards issued pursuant to the Federal Property and Administrative Services Act of 1949, as amended (i.e., for nickel and nickel base alloys, Fed. Std. No. 182B applies; for aluminum, magnesium and titanium, Fed. Std. No. 184B applies).
13. Part - One piece or two or more pieces joined together, which are not normally subject to disassembly without destruction.
14. Program Critical Hardware - That hardware uniquely critical to a flight-project schedule or mission because the hardware is designed to provide the fundamental function (structure, power, etc.) without which successful completion of the project's other hardware or the mission cannot be achieved.
15. Serial Number - A permanent number assigned sequentially to selected hardware which, in conjunction with the Part Number, permits isolation of the item and facilitates hardware allocation, traceability, accountability, location determination, and identifies design change effectivity.
16. Subassembly - An article composed of two or more parts which is one of the building elements of an assembly.
17. Traceability - The ability to trace the history, test reports, inspection records, application, and location of an individual part or material through the use of traceability identification numbers and accompanying records.
18. Unique Identification Numbers (UIN's) - Numbers assigned and attached (when feasible) to flight and flight associated hardware used in maintaining traceability. A UIN can consist of a serial number, trace number, lot number or date code (paired with the appropriate manufacturer's name or symbol), which relates the part or raw material to a specific manufacturing or quality control operation. The UIN's are separate from and additional to part numbers.

- a. Serial Number -See number 15 above.



- b. Lot Number - A unique number assigned to identify a group of identical parts that are produced concurrently by a common process. Lot number requirements apply to procured parts (lot number assigned by Configuration Management Release Desk), and parts manufactured in-house (lot number assigned by Configuration Management Release Desk).
- c. Trace Number - A number assigned to raw material for identification prior to fabrication and subsequent lot or serial number assignment.
- d. Date Code - A number which indicates a specific date in code. A date code may consist of a series of numbers that indicate day, week, month, or year.
- e. Inspection Report (IR) , MSFC Form 312 - A numbered MSFC quality control document used to reflect the configuration and quality status of a part, component, subassembly, or assembly.



APPLICATION GUIDANCE

1. Part/assembly Identification - Part Identification Numbers (PIN's), as specified in reference e., shall be used to identify parts and assemblies built to MSFC engineering drawings. Part and assembly identification for contracted or purchased parts and assemblies will be in accordance with requirements specified in procurement documents. Serial numbers, lot numbers/date codes shall be recorded/documented and, as practical, physically affixed to the equipment/hardware.
  - a. Serial Numbers - The following types of equipment/hardware and their next higher assemblies, which are identified on engineering drawings/Engineering Parts Lists (EPL's) as requiring traceability, will be serialized:
    - (1) Electro-mechanical, Electrical, Electronic (EEE), and mechanical assemblies and subassemblies which are replaceable or repairable such as valves, actuators, pressure vessels, batteries, telemetry multiplexers, amplifiers, transducers, modules, printed circuit boards, etc.
    - (2) Structural items having critical design significance which must be controlled and for which test and inspection records are required and maintained (e.g. fracture critical parts, pressure vessel assemblies, forgings, castings, extrusions, etc.).
    - (3) Articles or assemblies subject to time-cycle variation limitations, periodic checkout, calibration, servicing and maintenance, and reinspection.
    - (4) Articles requiring selective fits for matched sets of functional assemblies.
    - (5) Multiple items manufactured to the same drawings.

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- b. Lot Number and/or Date Codes - The following types of equipment/hardware identified on engineering drawings/EPL's as requiring traceability will have lot number and/or date codes and applicable manufacturer's Commercial and Government Entity (CAGE) Code applied:
- (1) Electronic parts, such as transistors, resistors, diodes, capacitors, switches, connectors, and relays. Additional traceability requirements for electronic parts are addressed in reference d.
  - (2) Items fabricated from a common lot of raw material, heat, batch, or process, such as non-critical forgings and castings, fittings, or items which are subjected to destructive acceptance sampling such as fasteners and pyrotechnic devices.
  - (3) Raw materials such as plastic molding powder and molded parts, electrical potting compounds, paints, greases, adhesives, welding rod or wire, and gasket materials.
2. Material Traceability Levels - For all flight and flight associated hardware and materials for which traceability is required, Design Engineers will recommend traceability levels to the Chief Engineer. Final determination of material traceability levels rests with the Program/Project Manager.

Applicable traceability levels, listed below, shall be specified on the Engineering Drawing. Emphasis should be placed on consequences of hardware failure over payload classification when determining material traceability levels. Specific traceability requirements for EEE parts will be in accordance with reference d.

- a. Material Traceability level 1 : Requires (a) records containing actual chemical and physical material verification test results, (b) Certificates of Conformance (COC), (c) detailed process, inspection and discrepancy records traceable to the material from which fabrication originated, and (d) in-house chemical and physical verification testing.

The requirement for Level 1 material traceability is appropriate for hardware whose failure will result in loss of life, overall mission, Class A/B payload, or launch vehicle. Level 1 material traceability requirements provide the highest degree of traceability confidence by requiring in-house chemical and physical verification testing in addition to other stringent traceability documentation requirements.

- b. Material Traceability Level 2 : Requires (a) records containing actual chemical and physical material verification test results, (b) Certificates of Conformance (COC), and (c) detailed process, inspection and discrepancy records traceable to the material from which fabrication originated.

The requirement for at least level 2 material traceability is appropriate for hardware whose failure will result in loss of life, overall mission, Class A/B payload or launch vehicle (the same class of hardware as level 1) and for which in-house testing is not justified. Level 2 traceability requirements provide a high degree of material traceability confidence without the added cost of in-house chemical and physical verification testing.

- c. Material Traceability Level 3 : Requires (1) Certificates of Conformance (COC) and (2) limited in-house chemical and physical verification testing or typical chemical and physical material verification test results. In-house chemical and physical testing, as determined by the design organization, can be used to assure that material is in compliance with material/drawing specifications in the event that a COC is unavailable.

The requirement for level 3 material traceability is appropriate for hardware whose failure will not result in loss of life, overall mission, class A/B payload or launch vehicle (i.e., hardware within a class C/D payload whose failure will affect only that C/D payload). Limited in-house testing on test specimens (i.e., hardness testing, conductivity testing, portable mass spectrometry testing) is appropriate at this level of traceability.

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- d. Material Traceability level 4 : Requires a Certificate of Conformance (COC), Mill Marking or trace number as defined by this instruction.

The requirement for level 4 material traceability is appropriate for hardware for which it is not feasible or not deemed necessary to require detailed raw material traceability (i.e., computer chips which would be traceable by lot number/or date code only; raw material for which available traceability is limited to Mill Markings, etc.) and whose failure will not result in loss of life, overall mission, class A/B payload or launch vehicle. Level 4 material traceability is also appropriate for use in addressing traceability for commercial parts and off-the-shelf hardware for which no formal traceability exists.

3. Exempted Equipment - Prototype equipment used in-house for engineering evaluation only (at the discretion of the Chief Engineer), manufacturing tooling, transportation, facility type equipment, does not require maintenance of traceability.
4. Records System - The records system will provide for tracing from the highest level of assembly back to the lowest level specified for introduction of UIN's. The related data and records will be adequate, to enable analysis of problems, locate hardware within assemblies/subassemblies and to ensure timely and effective corrective action.
5. Records Retention - In-house traceability records and traceability records submitted by contractors in accordance with procurement requirements shall be retained by the MSFC Quality Assurance Office until the article has been used for its intended purpose (e.g., flown, replaced, expended etc.) or is authorized for disposal. Traceability records retained by the contractor or supplier will be according to the provisions of the contract.

Records for traceability on hardware that will be reused or has the potential for reuse on other projects will be retained for an additional time as required by the Program/Project Office.

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MMI 5300.12B  
ATTACHMENT B

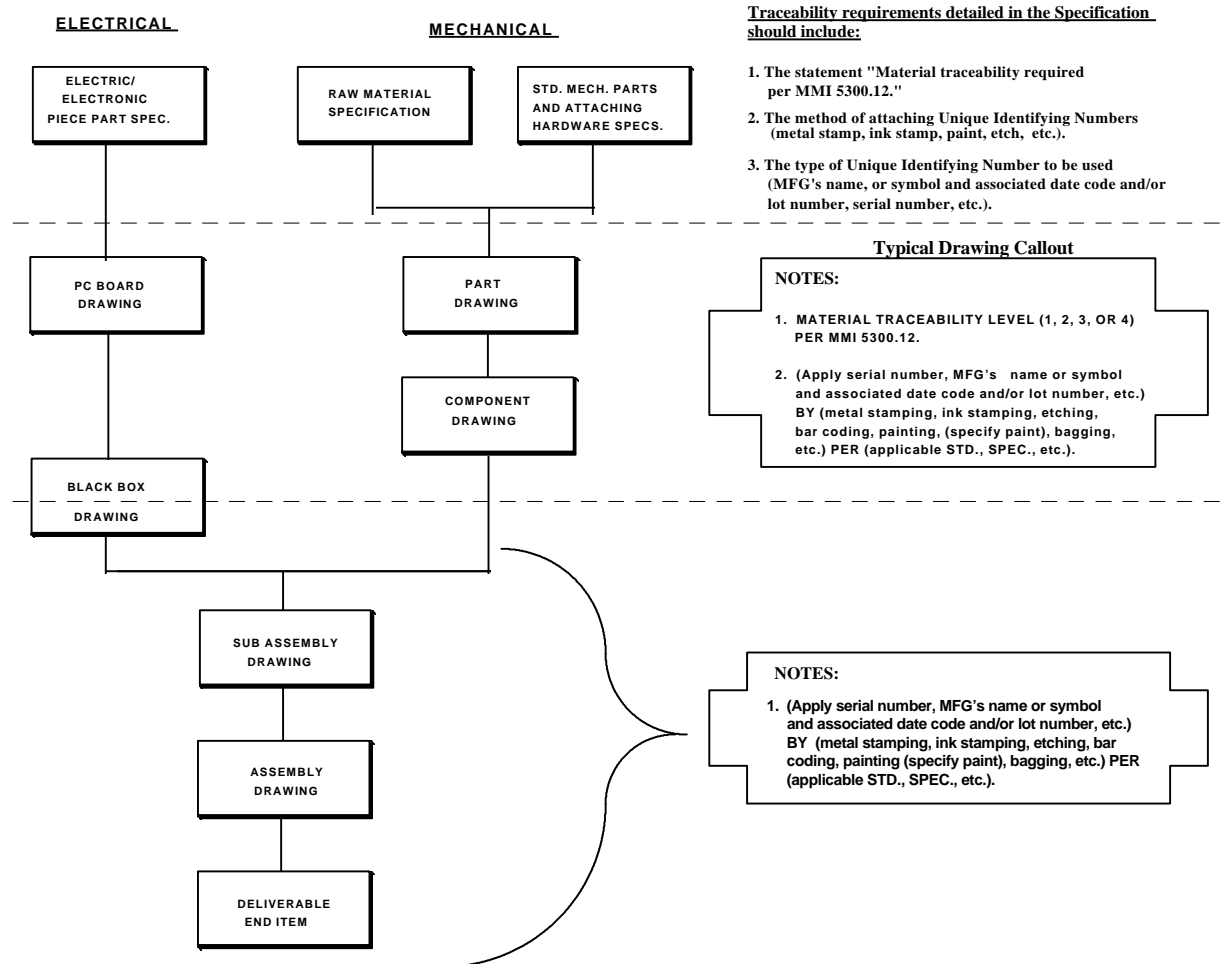


Figure 1 - Typical Sequence for Specifying Traceability  
Requirements on Engineering Drawings